3.3.6. Mission Utility and Integration

3.3.6.1. Purpose

The purpose of this test is to qualitatively assess the utility of the INS and its integration with the other aircraft systems.

3.3.6.2. General

In most cases, the INS is not a stand alone system. Many modern avionics systems require navigation inputs. Radar and Forward Looking Infrared Radar (FLIR) displays and antennas are often geographically stabilized using INS inputs. The INS can use sensor and other navigation system inputs for position updates. Navigation information is often displayed on radar and FLIR displays, tactical displays and HUDs. A typical system will use radar input to the navigation system as initial steering to the target (the navigation system also is stabilizing the radar scan center to maintain detection of the target). The navigation input is then used to steer the FLIR onto the target for a FLIR handoff. The navigation cues are provided on the HUD, often including an INS stabilized target designator box, to aid in visually finding the target. If detection is lost, such as during the terminal phase of a DBS radar attack, the INS provides final attack cues. Finally, during the weapons release, the INS provides inputs to the weapons computer to calculate the proper release point, again providing cues to the pilot.

In most cases, the INS requires the widest integration within the complete aircraft of any system and as such is the most challenging to test for integration. Since the output of the INS (latitude and longitude) is rarely used directly by the pilot, the issue of integration and accuracy nearly completely define the utility of the INS.

The utility and integration of the INS can only be evaluated during mission relatable tasks. For an attack aircraft, the evaluation must be performed during mission relatable ingresses to the target area, detection of the target, handoff between the sensors as would be expected in a tactically significant attack (for example a handoff from a long range radar detection to a FLIR attack),

selection of a weapon and attack mode and finally a safe egress from the target area. For a fighter, the evaluation requires navigating to and from a Combat Air Patrol (CAP) station, steering cues to a radar designated target, handoff to an air-to-air FLIR or other electro-optic sensor for VID as well as navigation inputs to digital data links and tactical displays. The critical requirement is to select a scenario that reflects the most likely use of the aircraft and to use this scenario during the evaluation. For the purpose of this sample test procedure, the test aircraft will be an attack aircraft with a weapons computer, HUD, radar and FLIR as well as the TACAN and OMEGA systems used to demonstrate the previous tests.

3.3.6.3. Instrumentation

Data cards are required for this test. A voice recorder is highly recommended.

3.3.6.4. Data Required

Record qualitative comments concerning the integration of the INS with the aircraft weapons computer, FLIR, HUD, radar, TACAN and OMEGA. Include comments concerning the INS inputs to these systems as well as the radar, TACAN and OMEGA inputs to the INS for INS updates. Evaluate the effects of INS accuracy upon other systems, for instance the drift rate of radar and FLIR geographically stabilized cursors, once a target is selected, and the resulting workload as the cursors are repeatedly updated. Evaluate the effects of navigation functions, such as INS update procedures, upon operator workload in a mission relatable environment. Assess the utility of the INS derived information displayed upon the radar, FLIR, HUD and INS unique displays including the effects of INS accuracy, while performing radar to FLIR or HUD handoffs and mission relatable ingresses, attacks and egresses.

3.3.6.5. Procedure

Select a mission relatable target in the test area that allows for a 35 to 40 nm ingress to the target location. Select several waypoints inbound to the target. While navigating from the home airfield to the initial waypoint, qualitatively assess the utility of the INS accuracy and steering cues for long range, IMC navigation. Choose an altitude and airspeed that conserves fuel. Descend to a low ingress altitude and set an airspeed near the sea level limit of the

test aircraft. Head inbound to the
target and select a radar mapping mode
with at least a 40 nm scale and a wide
scan pattern useful for radar mapping.
Follow the INS and radar cues inbound to
the target, passing over the waypoints
along the route. Select DBS radar modes
inbound to the target and when inside of
10 nm perform a handoff of the target
from the radar to the FLIR. Continue
inbound to the target, performing a
mission relatable unguided ordnance
attack. Following the attack, turn
outbound from the target and navigate to
the initial point on the reverse route
using the radar and INS cues. Repeat
with different weapons deliveries as
time allows. Use a voice recorder or
write down comments after each run.
Care should be taken not to become
distracted with recording data to allow
the best overall qualitative evaluation.

3.3.6.6. Data Analysis and Presentation

Relate the qualitative deficiencies
noted to their effects upon the
performance of normal IFR navigation,
ingresses and attacks. Note any
limitations upon tactics imposed by the
INS accuracy, utility or integration.
For instance, the navigation cues used
to find the waypoints may require so
much operator attention and
interpretation that they destroy the
scan of the radar display while
searching for the target. As another
example, the INS drift may be so high
that the stored position of the target
may drift radically between the last
radar or FLIR update and the weapons
release, causing a miss of the target.
It is critical that the INS utility and
integration should not be driving
tactics. Use the applicable results
from the previous tests to support the
qualitative results.

3.3.6.7. Data Cards

A sample data card is presented as card
43.

CARD NUMBER ___   TIME___ PRIORITY L/M/H

INS MISSION UTILITY AND INTEGRATION

[AFTER TAKEOFF, CLIMB TO _____ FEET MSL AND SET ___ KIAS. PERFORM INS NAVIGATION TO THE INITIAL POINT, ASSESSING THE UTILITY OF THE INS'S ACCURACY AND DISPLAYS FOR IMC NAVIGATION. DESCEND TO ___ FEET AGL AND SET ___ KIAS AT THE INITIAL WAYPOINT. SET A 40 NM RADAR SCALE AND __˚ SCAN ANGLE LIMIT. SEARCH FOR THE TARGET ON THE RADAR WHILE NAVIGATING TO THE WAYPOINTS. AT 10 NM, PERFORM A FLIR HANDOFF. PERFORM A_____ ATTACK. AFTER RELEASE, REVERSE THE INGRESS TRACK. REPEAT USING A _____, _____ AND _____ ATTACK AS FUEL ALLOWS.]

TARGET POSITION _____ _____

INITIAL WAYPOINT 1 POSITION _____ _____

WAYPOINT 2 POSITION _____ _____

WAYPOINT 3 POSITION _____ _____

NOTES:

Card 43: INS Mission Utility and Integration Data Card